employed various sources of heat, including that of the electric lamp. The lime-light he found very convenient. With the lime-light and concave mirror, sounds of surprising intensity were produced by all the highly absorbent gases and vapours. Among gases chloride of methyl was loudest. Conveyed directly to the ear by a tube of india-rubber, the sound of this gas seemed as loud as the peal of an organ. Abandoning the ear-tube, and choosing a suitable recipient for the gas, the sounds were heard at a distance of 20 feet from their origin. As regards intensity, the order of the sounds, in gases, corresponds exactly with the order of their absorptions of radiant heat.

Among vapours sulphuric ether stands highest, this result being in part due to the great volatility of the liquid. But the intensity of the sound is by no means wholly dependent on volatility. The specific action of the molecules on radiant heat is as clearly shown in these experiments as in those previously conducted with the experimental tube and thermopile. Upwards of eighty vapours have been tested in regard to their sound-producing power.

With regard to aqueous vapour, whose action upon radiant heat even the latest publications on this subject describe as *nil*, it was especially interesting to be able to question the vapour itself as to its absorbent power, and to receive from it an answer which did not admit of doubt. A number of bulbs about an inch in diameter were placed under the receiver of an air-pump, with a vessel containing sulphuric acid beside them. When thoroughly dry they were exposed to an intermittent beam. The well-dried air within the bulbs proved silent, while the slightest admixture of humid air sufficed to endow it with sounding power. Placing a little water in a thin glass bulb, and heating it nearly to its boiling point, the sounds produced by the developed vapour are exceedingly loud. The bulbs employed in these experiments are usually about a cubic inch in volume. They may, however, be reduced to one-fiftieth or even one one-hundredth of a cubic inch. When a minute drop of water is vaporised within such little bulbs, on their exposure to the intermittent beam loud musical sounds are produced.

It is to be borne in mind that the heat employed in these experiments, coming as it did from a highly luminous source, was absorbed in a far smaller degree than would be the heat from bodies under the temperature of incandescence.

To render the correlation of sound-producing power and adiathermancy complete, all the gases and vapours which had been exposed to the intermittent beam were examined as to the augmentation of their elastic force through the absorption of radiant heat. A glass cylinder, 4 inches long and 3 inches in diameter, had its ends closed with transparent plates of rock-salt. Connected with this cylinder was a narrow U-tube, containing a coloured liquid which stood at the same level in the two arms of the U. The cylinder could be exhausted at pleasure or filled with a gas or vapour. When filled, the sudden removal of a double-silvered screen permitted the beam from the lime-light to pass through it, the augmentation of elastic force being immediately declared by the depression of the liquid in one of the arms of the U-tube and its elevation in the other. The difference of level in the two arms gave, in terms of water-pressure, a measure of the heat absorbed. With the stronger vapours it would be easy with this instrument to produce an augmentation of elastic force corresponding to a water-pressure of a thousand millimetres. As might be expected the intensity of the sounds corresponded with the energy of the absorption, varying from "exceedingly strong," "very strong," "strong," "moderate," "weak," to "inaudible." In this connection reference was made to the interesting experiments of Prof. Röntgen, an independent and successful worker in this field.

In conclusion, the lecture draws attention to the bearing of its results upon the phenomena of meteorology. The views of Magnus regarding the part played by mist or haze, are referred to and attention is directed to various observations by Wells which are in opposition to these views. The observations of Wilson, Six, Leslie, Denham, Hooker, Livingstone, Mitchell, Strachey, and others are referred to and connected with the action of aqueous vapour upon solar and terrestrial radiation. Many years ago the lecturer sought to imitate the action of aqueous vapour on the solar rays by sending a beam from the electric light through a layer of water, and afterwards examining its spectrum. The curve representing the distribution of heat resembled that obtained from the spectrum of the sun, the invisible calorific radiation being reduced by the water from nearly eight times to about twice the visible. Could we get above the screen of atmospheric vapour, a large amount of the ultra-red rays would assuredly be restored to the solar spectrum. This conclusion has been recently established on the grandest scale by Prof. Langley, who on September 10 wrote to the lecturer from an elevation of 12,000 feet on Mount Whitney, "where the air is perhaps drier than at any other equal altitude ever used for scientific investigation." An extract from Prof. Langley's letter will fitly close this summary :—"You may," he says, "be interested in knowing that the result indicates a great difference in the *distribution* of the solar energy here from that to which we are accustomed in regions of ordinary humidity, and that while the evidence of the effect of water-vapour on the more refrangible rays is feeble, there is, on the other hand, a systematic effect due to its absence, which shows, by contrast, its power on the red and ultra-red in a striking light. These experiments also indicate an enormous extension of the ultra-red rays beyond the point to which they have been followed below, and being made on a scale different from that of the laboratory—on one indeed as grand as nature can furnish—and by means wholly independent of those usually applied to the research, must, I think, when published, put an end to any doubt as to the accuracy of the statements so long since made by you, as to the absorbent power of water-vapour over the greater part of the spectrum, and as to its predominant importance in modifying to us the solar energy."

SOCIETIES AND ACADEMIES

LONDON

Royal Society, December 8.—"On the Electrolytic Diffusion of Liquids," by G. Gore, LL.D., F.R.S. In this communication the author has described an apparatus, and an attempt made with it, to ascertain more definitely than he was able in a previous research (on "the Influence of Voltaic Currents on the Diffusion of Liquids," *Proc.* Roy. Soc., No. 213, 1881) whether, when an electric current is passed vertically through the boundary surface of mutual contact of two electrolytes lying upon each other in a narrow vertical glass tube, the mass of either of the liquids expands or moves as a whole in the line of the current, and also to obtain additional data to assist in explaining the phenomena observed in the previous research.

The results obtained with a solution of mercuric nitrate (sp. gr. 1·30) below, and a solution of cupric nitrate (sp. gr. 1·22) above, showed, first, and most conclusively, that the upper liquid diffused downwards continuously through the meniscus in the glass tube (the meniscus remaining motionless) during the passage of an upward electric current; and second, that either no manifest expansion occurred in the liquid next the cathode in the upper solution, and that equal volumes of liquid diffused in two opposite directions through the meniscus; or that any expansion of the upper liquid was compensated for by downward diffusion of an equal bulk of that liquid. Another possibility was that the united volumes of metallic-electro deposited copper, and of the acid element from which it had been separated by electrolysis, were greater than before such separation, and that this was exactly compensated by the volume of liquid diffused downwards through the meniscus.

Zoological Society, December 13.—Prof. W. H. Flower, F.R.S., president, in the chair.—Mr. Sclater exhibited and made remarks on two skins of a Rail from Macquarie Island, south of New Zealand, which had been sent to him by Sir George Grey, K.C.B.—Mr. H. Seebohm exhibited and made remarks on specimens of the Rusty Grakle (*Scolecophagus ferrugineus*) and Pallas's Great Grey Shrike (*Lanius major*), which had been shot near Cardiff, and were new to the British avifauna.—A communication was read from Mr. Clements R. Markham, F.R.S., containing an account of his researches into the former whale-fishery of the Basque Provinces of Spain.—Messrs. J. J. Lister and J. J. Fletcher read a paper on the condition of the median portion of the vaginal apparatus in the Macropodidæ, in which they arrived at the following conclusions :—(1) In the Macropodidæ the median vaginal canal is closed in early life. (2) In the genera *Macropus*, *Halmaturus*, and *Petrogale* (and perhaps also *Dorcopsis* and *Dendrologus*) an opening is formed, leading directly from the median vaginal canal into the urogenital sinus, which opening most probably gives passage to the young. This opening may be formed early in life, as is usual in the genus *Halmaturus*, or not till young are about to be

produced, as in *Macropus rufus*. (3) The evidence with regard to *Macropus major* is conflicting; in one case the median canal has been found open after parturition, and in two others closed. (4) In *Hypsiprymnus gaimardi* (and probably also *H. murinus*) the median canal remains closed, and the young passes down the lateral vaginal canals, which present a different structure from that found in the other examples of Macropodidæ.—A communication was read from the Rev. Canon Tristram, containing the description of a new Fruit-Pigeon of the genus *Carpophaga*, from the Louisiade Archipelago, which he proposed to name *Carpophaga salvadorii*.

Geological Society, December 7.—Mr. R. Etheridge, F.R.S., president, in the chair.—William Amherst Tyssen Amherst, M.P., Robert Edward Cresswell, W. R. Eaton Hodgkinson, Simon D. Macdonald, Rev. Edward Cook Pritchard, Rev. Alexander Simpson, B.Sc., Prof. William Waagen, Ph.D., Frederick John Webb, and Charles Henry Wilson, were elected Fellows of the Society.—Mr. W. Topley made a statement respecting the International Geological Congress at Bologna.—Prof. Judd, at the request of Prof. John Milne, of the Imperial Engineering College of Tokio, Japan, called the attention of the Members of the Society to the important work now being carried on by the Seismological Society of Japan. Geologists could become Members of the Seismological Society of Japan (which stands greatly in need of help) by an annual payment of 1*l*., which will entitle them to receive the whole of the publications of the Society. Prof. Judd was prepared to receive the names of Members on behalf of Prof. Milne.—The following communications were read:—The zones of the Blackdown beds and their correlation with those at Haldon, with a list of the fossils, by the Rev. W. Downes, B.A., F.G.S.—On some new or little-known Jurassic Crinoids, by P. Herbert Carpenter, M.A. Communicated by Prof. P. Martin Duncan, M.B. Lond., F.R.S., F.G.S.—Notes on the Polyzoa of the Wenlock shales, Wenlock limestone and shales, over the Wenlock limestone. From material supplied by G. Maw, F.L.S., F.G.S. By G. R. Vine. Communicated by Dr. H. C. Sorby, F.R.S., V.P.G.S.

Anthropological Institute, December 13, 1881.—Mr. Hyde Clarke, vice-president, in the chair.—The election of Mrs. C. Hancock was announced.—The discussion on the Rev. R. H. Codrington's paper on the affinity of the Melanesian, Malay, and Polynesian languages was continued by Mr. A. H. Keane and Mr. Hyde Clarke.—Mr. M. J. Walhouse read a paper on some vestiges of girl-sacrifices, jar-burial, and contracted interments in India and the East. The great megalithic forms of interment, consisting of Kistvaens, or sepulchral underground chambers, formed of four huge slabs, covered with an immense capstone, and surrounded by a circle of standing stones, abound in nearly all the provinces of the Madras Presidency; but beside these there is another description of burial peculiar to the region of the western coast from Malabar to Cape Comorin. This consists of huge mortuary jars or urns, pear shaped, usually about five feet high by four feet in girth round the shoulders, and tapering to a point at bottom. They are of coarse, thick, red ware, wide-mouthed, generally with a rude incised cross-pattern round their neck. These great urns are buried upright in the ground, not in any cist or chamber, and a large flat stone or slab is laid over them, but no circle of stones ever placed around. They are filled with earth, and contain at the bottom a quantity of bones broken small, some pieces of iron, and occasionally a small urn also filled with bits of bone; or sometimes with clean sand, red or white, which must have been brought from a distance.—Mr. G. Bertin read a paper on the origin and primitive home of the Semites, which was followed by a discussion.

Entomological Society, December 7.—Mr. H. T. Stainton, President, F.R.S., in the chair.—Mr. A. J. Scollick was elected a Member.—Exhibitions: A variety of *Ennomos tiliaria*, Borkh., by Mr. W. E. Boyd.—Bred specimens of *Scenopinus fenestralis*, Latr., *Phora rufipes*, Meig., and *Oscinis pusilla*, Latr., by Mr. C. O. Waterhouse.—A larva of an undetermined species of ant-lion, from Zante, by Mr. F. P. Pascoe. A Curculionideous larva, found feeding in the bulbs of lilies, probably from Japan, by Mr. R. McLachlan.—A specimen of *Harpalus cupreus*, Dej., from the Isle of Wight, by Mr. A. S. Olliff.—A supposed new species of *Telephorus*, from West Wickham, by Mr. H. B. Pim.—Communications: a box of locust egg-cases, with specimens of the Bombyliid larva found feeding on the eggs, transmitted by Sir Robert Biddulph from Cyprus, was exhibited by the Secretary, who read a communication received therewith from the Colonial Office, and the report of the Committee appointed by the Society to investigate the subject.—Sir S. S. Saunders read some remarks received from M. E. André, relative to a species of *Scleroderma*.—Mr. C. O. Waterhouse read remarks on the types of *Cynips psenes* and *C. sycomori*, in the Linnean collection.—Mr. W. L. Distant read descriptions of new species belonging to the Homopterous family *Cicadidæ*; and Mr. A. G. Butler communicated a list of heterocerous *Lepidoptera* collected in Chili by Mr. T. Edwards; Part i., Sphinges and Bombyces.

VIENNA

Imperial Academy of Sciences, December 9, 1881.—V Burg in the chair.—The following papers were read:—Ed. Neusser, a contribution to the knowledge of the colouring-matters of urine.—Bohuslav Branner (Manchester), contribution to the knowledge of cerium metals.—N. v. Lorenz, on the action of metallic lead on an aqueous solution of nitrate of lead.—Willibald Vinier, a sealed packet without inscription.—G. Tschermak, on a previously unobserved case of hemhedry of fesseral system.—E. Weiss and T. Palisa, computation of the elements and ephemeris of the comets probably discovered by Mr. Wendell of Harvard College at Cambridge (Mass.).—W. Tinter, on the error made on putting the cross-wires into the plane of image.

December 15, 1881.—L. T. Fitzinger in the chair.—The following papers were read.—L. Boltzmann, on the theory of the viscosity of gases (part 3).—Some experiments made on the impact of cylinders, by the same.—Fr. Brauer, on the Diptera of the Imperial Museum at Vienna.—A. v. Heider, on the genus *Cladocera*, Ehrenberg.—T. Gaunersdorfer, contributions to a knowledge of the nature of the *heart-wood*.—O. Tumlirz, on the flow of an incompressible liquid through pipes of circular section and of any one shape and situation.—On the rotatory movement of a homogeneous liquid around an axis by influence of friction, by the same.—Bela Haller, on the anatomy of the nervous system of the *Muricida*.—T. V. Rohon, researches on *Amphioxus lanceolatus*.—F. Lorenz, on the skeletons of *Stringops habroptilus* and *Nestor notabilis*.—L. v. Barth and M. Kretschy, on the *Pirotoxin* question.—Sig. Freud, on the structure of nerve-cells of the crayfish.—T. Liznar, on the results of magnetic measurements made in Moravia and Silesia.

PARIS

Academy of Sciences, December 12, 1881.—M. Daubrée in the chair.—The following papers were read:—Surveys and itineraries executed in Tunis, by M. Verrier.—Experiments on the rapidity of absorption of virus at the surface of wounds, by M. Davaine. Small portions of the skin of rabbits were cut out with scissors, and fresh virulent anthracic blood was spread on the wound. After one hour or more, the wound was deeply cauterised. Two-thirds of the animals were preserved (a result quite different from those of Renault and M. Colin, who inoculated animals after making a small sub-epidermic incision, and found cauterisation unavailing. An explanation is offered).—On groups of binary forms having the same Jacobian, by M. Stephanos.—Researches with a view to discover organisms parasitic on phylloxera, by M. Gayon. He found microscopic organisms in a small percentage of phylloxeras examined, and tried to cultivate them. Chicken-broth neutralised with potash, and having a phylloxera (first scorched in flame), or some liquid from its body, put into it, soon swarmed with agile rods (bacteria or vibrions), but the author is not sure that the alterative germs were always from the insects (the development being constant). A curious green crystal-yielding product of those microbes, is noted. M. Gayon, is pursuing his studies.—On equations of the form $\Sigma \int_a^b e^{-zx} F(z)dx = 0$, by M. Laguerre.—On a series of Abel, by M. Halphen.—Remarks on the introduction of continuous functions not having a derivative, into the elements of mechanics, by MM. Appell and Jannand.—On a class of functions analogous to Θ functions, by Mr. Elliott.—On international polar expeditions, by M. Mascart. The object is to study, not the formation and course of cyclones, but terrestrial magnetism and allied phenomena; and in this respect the importance of polar stations is indubitable.—On the methods of comparison of induction coefficients, by M. Brillouin.—On the specific heats of gases at high temperatures, by MM. Mallard and Le Chatellier. They find the mean specific heat of carbonic acid, at constant volume, between 1800° and 0° (referred to the equivalent 44), to be represented by 12·6. It increases

continuously up to 2000°, but the rate of increase diminishes with removal from 0°. The formula gives a maximum of 13·7 at 2160°. The specific heats of hydrogen, nitrogen, oxygen, and carbonic oxide, which are equal at 0°, are still so at temperatures exceeding 2000°. The mean specific heat of aqueous vapour, referred to the equivalent 18, is about 11·5 at 1600°.—On the solubility of sulphate of baryta and strontium in concentrated sulphuric acid, by MM. Narenne and Pauleau.—Processes of direct coppering of cast-iron, iron, and steel, by M. Weil. Three are described. The injurious and dear cyanides are replaced by organic acids, or by glycerine.—Pocket-battery with articulated elements, by M. Pulvermacher.—On the decomposition of water by electric effluves in presence of nitrogen, by MM. Deherain and Maquenne. The effluve of high tension causes direct combination of the nitrogen with the elements of the water, producing nitrite of ammonia. This effluve was also proved capable (like that of weak tension) of causing fixation of nitrogen in organic matters.—On the decomposition of metallic formiates in presence of water; production of some crystalline mineral species, by M. Riban.—On the influence of the choroid on acuteness of vision, by M. Fano. He describes observations of the vision of persons having choroidian atrophy.—On tetronerythrine in the animal kingdom, and its physiological *rôle*, by M. de Merejkowski.—On the origin of spermatozoids in hydrozoa, by M. de Varenne.—Note on some points still obscure in the organisation and development of Echinorhynchi, by M. Mégnin. The presence of a bifurcating intestine brings these Helminths towards Trematodes, and removes them from Nematoids.—On the characters presented by speech in deaf-mutes who have learned to articulate sounds, by Prof. Bell.—Observations on the last eruption of Mauna-Loa, from November, 1880, to August, 1881, by Mr. Green. He sends and discusses a series of photographs of the lava current, which is the most remarkable that has occurred within fifty years.

December 26, 1881.—M. Wurtz in the chair.—M. Favre presented a fourth and last batch of M. Chasles' scientific MSS. (the total numbering 113).—On some applications of the theory of elliptic functions, by M. Hermite.—Note on the mode of action of soluble ferments, by M. Wurtz. Pepsine and papaine being fixed, in the insoluble state, on certain albuminoid matters, so modify these that they can be hydrated at 40° by action of pure water, forming true peptones.—Classification of fractures of different orders (lithoclases), presented by the earth's crust, by M. Daubrée. Lithoclases are divisible into—I. Leptoclases: small fractures in two directions or one, and either synclases (*interior* mechanical action) or piesoclases (*exterior*); II. Diaclases: fractures often extending, with nearly plane form, more than 100 m. in horizontal or vertical direction. III. Paraclases: like diaclases, but often exceeding 1000 m. in horizontal direction, and presenting great outthrow of indefinite depth. Examples are given in a synoptical table.—Is the ramification in plants everywhere and always acropetal? by M. Trécul. He is led to a negative.—Reply to M. Daubrée's observations in the *séance* of December 19, by M. Blanchard. M. Blanchard had not questioned the existence of an interior sea in the tertiary epoch, about the end of which he had supposed it to disappear, through elevation. Mere isthmuses would have been insufficient for the dissemination which occurred.—Observations on the state of the Mediterranean at the close of the tertiary epoch, by M. Hébert. He gives evidence of an emersion, more or less, at the end of the miocene, and at the end of the pliocene In pliocene time (he thinks) the bottom had not the great inequalities observed now, these being due to dislocations in the quaternary epoch. On the successive differences of observations, by M. Bréger.—M. Malligand indicated the service rendered by his ebullioscope (for determination of alcohol in wines), which the French Syndical Chambers adopted in 1878.—Elements and ephemerides of the comet *g* 1881 (Swift), by M. Bigourdan.—On the successive differentials of functions of several independent variables, by M. Darboux.—On some examples of reduction of Abelian integrals to elliptic integrals, by M. Picard.—Note on naval tactics calculated by Lieutenants Des Portes and Aubert, under direction of Capt. Trève, by M. Trève.—On the works of the Swiss Seismological Commission, and on earthquakes recently experienced in Savoie, by M. Soret. A peculiar feature of some earthquakes, originating south-east of the Lake of Geneva, is that they had a strong effect on the north side of the lake, but were hardly felt on the south side, though this was nearer the place of origin.—On the function which expresses the gaseous state, and on the function λ, such that $\frac{dQ}{\lambda}$ is an exact differential, by M. Gouilly.—Contractions and dilatations produced by electric tensions in hemihedral crystals with inclined faces, by MM. Jacques and Pierre Curie. Between two bronze plates were secured two systems, the lower (to measure variations of pressure) formed of three large thin quartz plates separated by metallic plates, which were connected with an electrometer; the higher, of three large hemihedral crystals, separated by two copper rundles, on one of which were applied two bases positive by pressure, on the other two negative bases The two exterior bases communicated with earth; the two copper rundles with a Holtz machine. The dilatation of the upper system compressed the lower, and the electrometer was affected. The phenomenon was of the same order of magnitude as theory indicated.—On the decomposition of some metallic acetates in presence of water; production of crystalline mineral species, by M. Riban.—Influence of heat and proportions of glycerine on the decomposition of oxalic acid, by Mr. Lorin. The etherification of formic and oxalic acids is, in this class of experiments, a secondary accident.—On essence of angelica, by M. Naudin.—Method of purifying arsenious coppers, by M. Garnier.—Experimental researches proving that various causes, but especially lesions of the brain, may produce, after death, a general or local contraction, by M. Brown-Séquard.—On the mechanism of motor-troubles produced by excitations or lesions of the circumvolutions of the brain, by M. Conty. The circumvolutions do not seem to have any direct relation to the muscles; it is the spinal cord that plays the predominant *rôle* of centre of reaction and transformation.—On the excretion of uric acid in birds, by M. Cazeneuve. Experimenting with sparrow-hawks, he proved that the stimulation or diminution of combustion does not alter the ratio of the principles excreted. The totality of elements increases or diminishes with the quantity of food ingested; which depends on the stimulant or depressive conditions of the medium.—On the *Gastornis Edwardsii* and the *Remiornis Heberti* of the Lower Eocene of the environs of Rheims, by M. Lemoine.—Do the inferior Crustaceans distinguish colours? by M. de Merejowsky. They distinguish quantity, but not quality, of light.—Prolongation of the vegetative activity of chlorophyllian cells under the influence of a parasite, by M. Cornu. He mentions several cases of analogy to the state of lichens (which have vigorous life, though now understood to consist of an alga and a parasitic champignon).—On Sphenozamites, by M. Renault.—On the supposed organisms of meteorites, by M. Vogt. He controverts this theory of M. Hahn, and argues that the structures are inorganic.

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